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Association between recent respiratory tract infection/ pneumonia and risk of cardiovascular disease

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Abstract

Background: Cardiovascular disease (CVD) is the leading global cause of death, with emerging evidence linking respiratory tract infections (RTIs), including pneumonia, to increased cardiovascular risk. Acute infections may trigger events like myocardial infarction or stroke through inflammatory mechanisms, plaque destabilization, and endothelial dysfunction. In low- and middle-income countries like Bangladesh, where RTIs are common and CVD rates are rising, this association has significant public health implications. Studies show a two- to four-fold increased risk of acute coronary events post-infection, especially in the elderly.

Aim of the study: This study aims to explore the association between recent respiratory tract infections or pneumonia and the risk of cardiovascular disease among patients in a tertiary care setting in Bangladesh.

Methods: This cross-sectional analytical study was conducted over six months, from (start) to (end), at (hospital name) in Bangladesh to assess the association between recent respiratory tract infections (RTIs), including pneumonia, and cardiovascular disease (CVD) risk. A total of 100 adults aged 30 years or older were enrolled through purposive sampling, divided into two groups: 50 with recent RTI/pneumonia and 50 without. Data were collected via interviews, medical records and lab findings. Exclusion criteria included prior CVD and immunocompromised states. Statistical analysis using SPSS v26 included t-tests, Chi-square, and logistic regression to identify independent predictors of CVD, with significance set at $p<0.05$.

Results: The results revealed that individuals with recent RTI/pneumonia were older (56.4±9.8 vs. 52.0±10.9 years, P=0.045), predominantly male (66%), and more likely urban residents (P=0.011). Smoking (60% vs. 34%, P=0.008), diabetes (50% vs. 28%, P=0.021), and hypertension (62% vs. 40%, P=0.024) were more prevalent in this group. CVD occurred significantly more in RTI patients (56% vs. 30%, P=0.009). They also showed higher systolic BP (P=0.012), LDL (P=0.037), and lower HDL (P=0.021). RTI/pneumonia was independently associated with CVD (AOR=2.68; 95% CI: 1.21-5.95; P=0.015).

Conclusion: This study found a significant link between recent respiratory infections or pneumonia and increased cardiovascular disease risk in Bangladeshi adults, emphasizing the need for early infection control, proactive cardiovascular monitoring, and integrated care strategies to reduce complications and improve health outcomes in at-risk populations.

Keywords: Cardiovascular disease, respiratory tract infection, pneumonia and risk factors

Introduction

Cardiovascular disease (CVD) remains the leading cause of morbidity and mortality globally, accounting for an estimated 17.9 million deaths annually, which represents 32% of all global deaths [1]. Traditional risk factors for CVD such as hypertension, dyslipidemia, diabetes mellitus, smoking, and sedentary lifestyles have long been recognized. However, emerging evidence highlights the significant role of acute infections, particularly respiratory tract infections (RTIs), including pneumonia, in precipitating cardiovascular events such as myocardial infarction (MI), stroke, and heart failure [2, 3]. Respiratory tract infections, which encompass upper respiratory tract infections (URTIs) such as pharyngitis and sinusitis, and lower respiratory tract infections (LRTIs) including bronchitis and pneumonia, are among the most common infectious diseases worldwide.

In low- and middle-income countries (LMICs) like Bangladesh where communicable diseases are still prevalent, the burden of RTIs remains high, particularly among the elderly and those with chronic comorbidities [4]. While the immediate respiratory complications of RTIs are well understood, recent studies have revealed that these infections may have systemic implications, particularly on the cardiovascular system [5]. There is growing epidemiological and mechanistic evidence suggesting that acute infections can trigger acute cardiovascular events through a variety of pathways. Inflammatory responses to infection may destabilize atherosclerotic plaques, enhance coagulability, and lead to endothelial dysfunction, thereby increasing the risk of cardiovascular events such as myocardial infarction or stroke [6, 7]. Pneumonia, in particular, has been associated with a markedly elevated risk of cardiovascular complications both during the acute illness and in the months following recovery. Studies have reported a two- to four-fold increased risk of acute coronary syndromes within the first 30 days after pneumonia diagnosis [3]. Moreover, systemic inflammation and oxidative stress induced by respiratory infections can exacerbate existing cardiovascular conditions. The interplay between infection-induced cytokine storms and atherogenesis is well documented, where cytokines such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α) contribute to plaque rupture and thrombosis [8]. Additionally, hypoxia due to respiratory compromise and increased sympathetic activity during infection further strain the cardiovascular system, particularly in elderly patients and those with pre-existing heart disease [9]. In a landmark study by Kwong and colleagues (2018) [8], it was found that the risk of acute myocardial infarction was significantly increased in the first week following laboratory-confirmed influenza infection, reinforcing the notion that respiratory infections act as acute cardiovascular triggers. Similarly, in a meta-analysis by Barnes *et al*. (2015) [10], pneumonia was identified as a strong independent risk factor for subsequent CVD, particularly in individuals over 65 years of age. These associations have important public health implications, especially in LMICs where both infectious and non-communicable diseases co-exist in high burdens. In the context of Bangladesh, where the epidemiological transition is occurring with a dual burden of infectious and non-communicable diseases, the potential link between RTIs or pneumonia and cardiovascular disease warrants special attention. Bangladesh has seen a rise in CVD-related mortality, now accounting for nearly one-third of all deaths, while at the same time, RTIs remain among the top causes of outpatient visits and hospitalizations [11, 12]. Understanding the association between recent respiratory infections and cardiovascular risk can aid in early risk stratification, timely intervention, and integrated care models that bridge infectious disease management and cardiovascular health. Despite the growing body of international literature, data from South Asian populations including Bangladesh are limited. Most existing studies have been conducted in high-income countries, which may not fully represent the socio-demographic and health system contexts of LMICs. Moreover, factors such as poor access to healthcare, high prevalence of smoking, air pollution, and undiagnosed comorbidities may further compound the relationship between infections and cardiovascular events in this region. Therefore, this study aims to explore the association between recent respiratory tract infections or pneumonia and the risk of cardiovascular disease among patients in a tertiary care setting in Bangladesh.

Methodology and Materials

This was a cross-sectional analytical study conducted to evaluate the association between recent respiratory tract infections (RTIs), including pneumonia, and the risk of cardiovascular disease (CVD) among adult patients. The study was carried out in both outpatient and inpatient departments of (hospital name) in Bangladesh over a period of six months, from (start) to (end). A total of 100 participants were included using purposive sampling, with 50 individuals in each group. Sample size was determined based on previous literature showing increased CVD risk after respiratory infections and feasibility within the study period. Participants were divided into two groups:

- **Group A (With RTI/Pneumonia):** Individuals who had experienced a clinically diagnosed respiratory tract infection or pneumonia within the past three months.
- **Group B (Without RTI/Pneumonia):** Individuals with no history of recent RTI or pneumonia in the last three months.

Inclusion Criteria

- Age 30 years or older
- Complete medical records available
- For the exposed group, history of RTI/pneumonia (confirmed by clinical, radiological, or laboratory evidence) within the past three months

Exclusion Criteria

- Known history of cardiovascular disease prior to the infection (for exposed group)
- Immunocompromised patients (e.g., HIV, cancer on chemotherapy)
- Chronic lung diseases requiring long-term oxygen therapy
- Recent surgery or trauma in the past three months

Data collection tools and procedure

A structured data collection sheet was used to gather information through patient interviews, medical record reviews, and laboratory findings. The data sheet included:

- **Sociodemographic details:** Age, sex, residence, occupation, socioeconomic status
- **Behavioral risk factors:** Smoking, alcohol consumption, physical activity
- **Medical history:** Diabetes, hypertension, hyperlipidemia, COPD, vaccination status
- **Details of recent RTI/pneumonia (for Group A):** Symptomatology, diagnosis method, treatment, hospitalization, duration of illness
- **CVD outcomes:** Recent onset of myocardial infarction, angina, stroke, or heart failure confirmed by physician notes, ECG, or echocardiogram
- **Laboratory parameters:** Lipid profile, CRP, ESR, WBC count, chest X-ray (if available)

Blood pressure was measured using a standardized sphygmomanometer, and BMI was calculated using measured weight and height.

Statistical Analysis

Data were entered into SPSS version 26.0 for statistical analysis. Descriptive statistics were used to summarize demographic and clinical variables (means, standard deviations, frequencies, and percentages). Comparative analysis between groups was performed using Chi-square test or Fisher's exact test for categorical variables and independent sample t-test for continuous variables. Multivariate logistic regression analysis was conducted to determine independent predictors of CVD after adjusting for confounders such as age, sex, diabetes, smoking, and hypertension. A p-value of < 0.05 was considered statistically significant.

Results

As shown in Table 1, individuals with RTI/pneumonia had a higher mean age (56.4±9.8 years) compared to those without (52.0±10.9 years, P=0.045), and a greater proportion were male (66%) and urban residents (76% vs. 52%, P=0.011). Notably, smoking (60% vs. 34%, P=0.008), diabetes (50% vs. 28%, P=0.021), and hypertension (62% vs. 40%, P=0.024) were significantly more prevalent in the RTI group. Table 2 highlights that 30% of RTI cases were pneumonia, and 44% required hospitalization, with cough (92%) and fever (76%) being the most common symptoms. According to Table 3, CVD was significantly more common among those with recent RTI/pneumonia (56%) compared to those without (30%, P=0.009). The RTI group also had higher systolic blood pressure (142.5±16.8 vs. 135.1±14.2 mmHg, P=0.012), higher LDL cholesterol (142.6±30.4 vs. 129.7±27.8 mg/dL, P=0.037), and lower HDL (39.2±6.1 vs. 42.3±7.0 mg/dL, P=0.021). Finally, multivariate analysis in Table 4 showed that recent RTI/pneumonia was independently associated with increased odds of CVD (AOR=2.68; 95% CI: 1.21-5.95; P=0.015), after adjusting for age, smoking, diabetes, and hypertension.

Table 1: Demographic and Baseline Characteristics of Study Participants (N=100)

Variable	Group A (N=50) N(%) Mean ± SD	Group B (N=50) N(%) Mean ± SD	P-Value
Age (years, mean ± SD)	56.4±9.8	52.0±10.9	0.045*
Sex (Male/Female)	33/17	25/25	0.083
Urban Residence	38 (76%)	26 (52%)	0.011*
Smoking	30 (60%)	17 (34%)	0.008*
Alcohol Use	6 (12%)	5 (10%)	0.749
Comorbidities			
BMI (kg/m²)	25.7±3.1	24.5±3.6	0.071
Diabetes	25 (50%)	14 (28%)	0.021*
Hypertension	31 (62%)	20 (40%)	0.024*
COPD	12 (24%)	6 (12%)	0.13

Table 2: Infection Profile among Participants with Recent RTI/Pneumonia (N=50)

Variable	N	%
	Mean ± SD	
Type of Infection		
Upper RTI	15	30.00
Lower RTI	20	40.00
Pneumonia	15	30.00
Hospitalization Required	22	44.00
Antibiotics Taken	39	78.00
Duration of Illness (days)	9.5±3.8	
Symptoms Reported		
Cough	46	92.00
Fever	38	76.00
Dyspnea	21	42.00
Sputum Production	27	54.00

Table 3: Cardiovascular Disease Outcomes in Participants (N=100)

Outcome Variable	Group A (N=50) N(%) Mean ± SD	Group B (N=50) N(%) Mean ± SD	P-Value
Any CVD	28 (56%)	15 (30%)	0.009*
Myocardial Infarction	12 (24%)	5 (10%)	0.06
Stroke	6 (12%)	3 (6%)	0.295
Angina	18 (36%)	10 (20%)	0.079
Heart Failure	4 (8%)	2 (4%)	0.675
Systolic BP (mmHg)	142.5±16.8	135.1±14.2	0.012*
LDL (mg/dL)	142.6±30.4	129.7±27.8	0.037*
HDL (mg/dL)	39.2±6.1	42.3±7.0	0.021*
Triglycerides (mg/dL)	183.5±48.7	167.2±44.1	0.082

Table 4: Association between Recent RTI/Pneumonia and CVD (Multivariate Analysis)

Variable	Adjusted Odds Ratio (AOR)	95% CI	P-Value
RTI/Pneumonia (Yes vs No)	2.68	1.21-5.95	0.015*
Age	1.04	1.00-1.09	0.041*
Smoking	1.91	0.88-4.15	0.1
Diabetes	2.37	1.03-5.47	0.042*
Hypertension	1.79	0.81-3.93	0.148

Discussion

The current study aimed to investigate the association between recent respiratory tract infections (RTIs), including pneumonia, and the risk of cardiovascular disease (CVD) among patients in Bangladesh. The findings demonstrate a significant relationship, wherein individuals with recent RTI or pneumonia exhibited a notably higher incidence of CVD compared to those without such infections. These results align with an emerging body of global evidence indicating that acute infections can precipitate or exacerbate cardiovascular events through multiple physiological pathways. The analysis of demographic and clinical parameters (Table 1) revealed that individuals with RTI or pneumonia were generally older and more likely to be smokers, hypertensive, or diabetic. These are established risk factors for cardiovascular morbidity and may confound the infection-CVD relationship. However, after adjusting for these variables in multivariate logistic regression (Table 4), recent RTI or pneumonia remained an independent predictor of CVD with an adjusted odds ratio (AOR) of 2.68 (95% CI: 1.21-5.95; P=0.015). This suggests that the infection itself, beyond traditional risk factors, may play a causative role in cardiovascular complications. The mechanisms by which RTIs and pneumonia may contribute to CVD are multifactorial. Respiratory infections trigger systemic inflammation, which can destabilize atherosclerotic plaques and induce a prothrombotic state [13, 14]. Inflammatory cytokines such as interleukin-6 and tumor necrosis factor-alpha surge during infections, promoting endothelial dysfunction and increasing vascular permeability, which predispose to acute coronary syndromes [15]. Furthermore, infections may elevate blood viscosity and sympathetic activity, thus increasing myocardial oxygen demand and potentially resulting in ischemia, especially in vulnerable patients with pre-existing coronary artery disease [16]. Notably, previous research has reported a temporal link between pneumonia and cardiovascular events. A large cohort study by Corrales-Medina *et al*. [3] found that individuals hospitalized for pneumonia had an elevated risk of CVD events, particularly within the first 30 days post-infection. Similarly, a UK-based retrospective study using CPRD data indicated that the risk of myocardial infarction was significantly higher within the first week following acute respiratory infections [8]. Our study reinforces these findings within a South Asian population, which is often underrepresented in global cardiovascular epidemiology research. Interestingly, our study observed that 56% of participants with recent RTI or pneumonia had clinical evidence of CVD, compared to only 30% in the control group (Table 3). This is particularly concerning for Bangladesh, a lower-middle-income country facing a dual burden of infectious diseases and non-communicable diseases such as CVD. Factors such as urbanization, high smoking prevalence, poor air quality, and limited access to preventive care likely amplify this interaction [17]. Moreover, only 44% of patients with RTI or pneumonia were hospitalized, indicating that a substantial number of infections were either mild or managed in outpatient settings yet still contributed to cardiovascular risk. The findings also showed significant differences in lipid profiles and blood pressure between groups. Participants with RTI or pneumonia had higher LDL cholesterol (142.6 vs. 129.7 mg/dL; P=0.037), lower HDL (39.2 vs. 42.3 mg/dL; P=0.021) and elevated systolic blood pressure (142.5 vs. 135.1 mmHg; P=0.012). These alterations might reflect infection-related stress responses or underlying metabolic dysfunction, which further compound cardiovascular risk. Supporting this, Libby *et al*. [18] noted that systemic inflammation can impair lipid metabolism and accelerate atherogenesis. In addition to biological plausibility, public health considerations must be addressed. RTIs and pneumonia are common in Bangladesh, especially during winter and monsoon seasons, and often go underdiagnosed or undertreated due to socioeconomic barriers. Preventive strategies such as pneumococcal and influenza vaccinations already shown to reduce the risk of myocardial infarction and stroke in elderly populations are underutilized [19, 20]. Increased vaccination coverage could potentially mitigate infection-triggered CVD, particularly in high-risk groups such as those with diabetes or hypertension.

However, this study has several limitations. Its cross-sectional design precludes causal inference. Although associations were observed, we cannot definitively state that RTI or pneumonia caused the cardiovascular events. Longitudinal studies or cohort-based analyses would be more appropriate to establish temporality. Additionally, infection history was partially based on self-reporting, which may introduce recall bias. Last, laboratory and imaging data were not available for all participants, limiting the granularity of clinical characterization.

Conclusion and Recommendations

In conclusion, the study demonstrates a significant association between recent respiratory infections or pneumonia and increased cardiovascular disease risk among adults in Bangladesh. This highlights the importance of infection prevention, cardiovascular risk monitoring, and integrated healthcare approaches. Future prospective studies are needed to further delineate this relationship and develop targeted interventions in resource-limited settings.

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Conflict of Interest

Not available

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Not available

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